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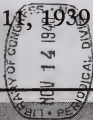
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#2

The Tenth
WRITERS' CONFERENCE,
University of Colorado.

A Mile High
In The Rocky Mountains

July 24 - August 14, 1939



Above Boulder

UNIVERSITY OF COLORADO
BULLETIN

1939

X-PN147

What Makes A Christian Writer?

by ELISE FRASER

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CHRISTIAN WRITERS CRITICISM SERVICE.
1136 Keith Avenue

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#4

AMERICAN DOCUMENTATION

*A QUARTERLY REVIEW OF IDEAS,
TECHNIQUES, PROBLEMS AND
ACHIEVEMENTS IN DOCUMENTATION*

VOL. II, NO. 4

FALL (OCTOBER) 1951

THE PRESENT STATE OF RESEARCH ON MECHANICAL TRANSLATION

by

Yehoshua Bar-Hillel *

* Research Laboratory of Electronics, Massachusetts Institute of Technology.

This work has been supported in part by the Signal Corps, the Air Materiel Command, and the Office of Naval Research.

Reprinted from AMERICAN DOCUMENTATION Vol. II No. 4

Wenn ein modernes Elektronenubermikroskop hinsichtlich seiner optischen Leistungsfähigkeit beurteilt wird, so steht fast immer die Frage im Vordergrund, bis zu welcher Grösse herab kleine Einzelheiten in getreuer Form dargestellt werden.

B. German Passage Rearranged for English Translation

Wenn ein modernes Elektronenubermikroskop wird beurteilt hinsichtlich seiner optischen Leistungsfähigkeit, so die Frage steht fast immer im Vordergrund, bis zu welcher Grösse herab kleine Einzelheiten werden dargestellt in getreuer Form.

Studies in Mechanical Translation

No. 2.

Some Problems of the Mechanical Translation of Languages

by

Erwin Reifler

Department of Far Eastern and Slavic Languages and Literature

University of Washington

No. 3

MT WITH A PRE-EDITOR

and

WRITING FOR MT

by

ERWIN REIFLER

Department of Far Eastern and Slavic Languages and Literature
University of Washington

Terms:

MT Mechanical Translation

MT Period Language Period for which a translation machine is designed.

Code Text Foreign text to be translated.

Target Text The product of MT.

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STUDIES IN MECHANICAL TRANSLATION

No. 3

MT WITH A PRE-EDITOR

and

WRITING FOR MT

by

ERWIN REIFLER

Department of Far Eastern and Slavic Languages and Literature

University of Washington

Terms:

MT Mechanical Translation

MT Period Language Period for which a translation machine is designed.

Code Text Foreign text to be translated.

Target Text The product of MT.

251

MT.....	Mechanical Translation.
MT Period.....	Language Period for which a translation machine is designed.
Code text.....	Foreign text to be translated.
Target text.....	The product of MT.

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STUDIES IN MECHANICAL TRANSLATION

No. 5

REPORT ON THE FIRST CONFERENCE ON MECHANICAL TRANSLATION, JUNE 17 - 20, 1952,

AT THE M.I.T., CAMBRIDGE, MASS.

by

ERWIN REIFLER

Department of Far Eastern and Slavic Languages and Literature

University of Washington

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Conference on Mechanical Translation

You are cordially invited to attend the public opening session of the Conference on Mechanical Translation on June 17, 1952 at 8:00 PM. in Huntington Hall, 10-250.

This session will have the form of a symposium. Five speakers will talk on various non-technical aspects of mechanical translation followed by a question-and-answer period for which all active participants of the conference will serve as a panel.

Only slight changes are expected in the following program.

Professor J. B. Wiesner, Director of the Research Laboratory of Electronics, M. I. T. --
Moderator

Dr. Y. Bar-Hillel, Research Associate, Research Laboratory of Electronics, M. I. T. --
Needs and possibilities for mechanical translation.

Professor Leon Costert, Georgetown University, Washington, D. C.
Human translation versus machine translation.

Dr. Olaf Helmer, Rand Corporation, Santa Monica, California
The structure of the problem of mechanical translation.

Dr. A. D. Booth, Electronic Computer Section, Birkbeck College, London, England
How intelligent can a machine translator be?

Dr. James W. Perry, Center of International Studies, M.I.T.
Machine techniques for index searching and translation.

Y. Bar-Hillel, Chairman
Organizing Committee

SOME LINGUISTIC PROBLEMS CONNECTED WITH MACHINE TRANSLATION¹

YEHOShUA BAR-HILLEL

During my recent work on machine translation (3), I have come across many problems of a linguistic nature that should be of general methodological interest. Some of these problems have never been treated extensively before. Others that have been discussed previously appear now in a different and rather interesting light.

The task of instructing a machine how to translate from one language it does not and will not understand into another language it does not and will not understand presents a real challenge for structural linguists, in that their thesis that language can be exhaustively described in non-referential terms undergoes here an *experimentum crucis*. If, in a translation program, some step has to be taken which directly or indirectly depends upon the machine's ability to understand the text on which it operates, then the machine will simply be unable to make this step, and the whole operation will come to a full stop. (I have in mind present day machines that do not possess a semantic organ. The situation will change in the not too distant future.)

I intend to deal with four specific problems, of which the only obvious common feature is the decisive role which they play in machine translation. The problems are, in the order in which they will be treated:

1. Operational Syntax
2. Intertranslatability of natural languages
3. Idioms
4. Universal syntactic categories

1. Operational Syntax. One of the decisive steps in certain methods of machine translation is the determination of the syntactic structure of any given sentence in the *source-language* (i.e., the language from which we translate) to a required degree of explicitness. Since thinking in terms of machines might perhaps be difficult for the reader, let him imagine an utterly moronic student without the slightest knowledge of either the source-language or the *target-language*, i.e., the language into which the given text is to be translated, and with an extremely restricted understanding of his own native language, but with the following abilities which are rather remarkable for a human being with such a constitution: he is able to identify the letter shapes of the source-language, he has an unailing and unlimited memory, and he is extremely fast in carrying out those instructions which are formulated in that small language fragment he understands. I shall not go into the detailed specification of these instructions. Let me mention only the two most important operations he is able to carry out: *matching* the given text or any part of it with any of a number of lists presented to him, and *counting*.

Though it might appear as if these operations were quite restricted in their

¹ This work has been supported in part by the Signal Corps, The Air Materiel Command, and the Office of Naval Research, and in part by the Rockefeller Foundation.

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LOGICAL SYNTAX AND SEMANTICS

YEHOSHUA BAR-HILLEL
Hebrew University, Jerusalem

Reprinted from LANGUAGE
Vol. 30, No. 2, April-June, 1954
Printed in U.S.A.

Words, indeed, the dictionary of the impossibility of a word-for-word translation (except in the special case of loan words) outlined in Frontiers for the Translational Analysis of German Syntax Patterns. The research of the summer of 1959 was begun by translating word by word into English various German texts in the field of mathematics. Our efforts rapidly came to grief, chiefly because of the lamentable fact that the German "articles" are also "verbs", but words of German transpositions were carried over into English. Also the learner-looking little form der. A word-by-word transverbalisation into English would require, to be complete, a listing of the following possibilities: "a" (der Mann); "of the" (der Raum or des Raumes); "to the" (der Ort) (also der Raum); "to" (der kommt nicht); "how, to how" (der geht nicht); "who" (der Mann, der kommt ...); "where" (die Frau, der ich es gab) -- and since all these admit variants. The other forms of the "article" require almost all equally complex transverbalisations. Then to circumstances such as these there is added the disturbing elusiveness of German word order, word-by-word translation from German into English becomes either a fiasco or a horror. To be quite sure of the impossibility of word-for-word translation, we constructed Chinese multiple-choice translations -- primitive versions of the "multiple-choice" appendix to The Frontiers of Research in Linguistics and these translations were submitted to our colleagues, colleagues.

WORD-BY-WORD TRANSLATION
(Victor A. Oswald, Jr.)

When I learned that I had been summoned to address myself to the topic of word-by-word translation I felt like a geographer invited to discuss the utility of the conception that the world is flat. In short, I can only say that word-by-word translation is not possible, if we are to understand by the term a wordwise transverbalization from one language into another, particularly from German into English.

It was, indeed, the discovery of the impossibility of wordwise translation that prompted the syntactical investigation outlined in Prolegomena to the Mechanical Resolution of German Syntax Patterns. The research of the summer of 1950 was begun by translating word by word into English various German texts in the field of mathematics. Our efforts rapidly came to grief, chiefly because of the lamentable fact that the German "articles" are also "words", but words of Protean transformations when carried over into English. Take the harmless-looking little form der. A word-by-word transverbalization into English would require, to be complete, a listing of the following possibilities: "the" (der Mann); "of the" (der Frau or der Frauen); "to the, for the" (also der Frau); "he" (der kommt nicht); "her, to her" (der geht); "his" (der Mann, der kommt ...); "whom" (die Frau, der ich es gab) -- and diverse other more subtle variants. The other forms of the "articles" require almost all equally complex transverbalizations. When to circumstances such as these there is added the distressing oddity of German word order, word-by-word translation from German into English becomes either a jest or a horror. To be quite sure of the impossibility of wordwise translation, we concocted diverse multiple-choice translations -- primitive ancestors of Mr. Bar-Hillel's appendix to "The Present State of Research on MT" -- and these translations we submitted to our mathematical colleagues,

CONCLUSIONS
(Richard L. Conrad, Jr.)

As I have said before, I am persuaded that we must produce the product of MT in such fashion that will make it, at the conclusion of our process, more or less immediately intelligible to a monolingual specialist in the field to which the translated text pertains. A general pre-editor (monolingual in the TL) can perform all sorts of useful tasks as you will see. I should like to assign him among other duties that of instructing the machine where to find the fracture surfaces of German compounds. A general post-editor (monolingual in the TL) should be required to shape the ends the machine has rough-hewn, in particular to smooth out the word order where the machine may have jumbled it. Above all, I should want to assign to a post-editor the task of choosing the most satisfactory preposition from the battery we shall have to provide in the TL for each preposition in the MT, and likewise to choose the appropriate equivalent from among the less formidable array of multiple choices for conjunctions. A monolingual general pre-editor, however, cannot efficiently aid in the interpretation of meaning-bearing words that have diverse significances in diverse contexts. A monolingual post-editor will inevitably be confronted with all sorts of contexts with which he is not familiar. Bilinguals, as I have pointed out, will be only a little better equipped to cope with the problem. For, if we assume we can resolve patterns of syntactic connection from the MT into the TL -- as I am sure we can -- and if we assume that we can supply at a reasonable speed all the possible significances in the TL for each meaning-bearing word in the MT, then the competence required for the ultimate interpretation of the text is not linguistic insight or skill, but

MICROSEMANTICS
(Victor A. Oswald, Jr.)

As I have said before, I am persuaded that we must devise the product of MT in some fashion that will make it, at the conclusion of our process, more or less immediately intelligible to a monolingual specialist in the field to which the translated text pertains. A general pre-editor (monolingual in the FL) can perform all sorts of useful tasks; as you will see, I should like to assign him among other duties that of instructing the machine where to find the fracture surfaces of German compounds. A general post-editor (monolingual in the TL) should be required to shape the ends the machine has rough-hewn, in particular to smooth out the word order where the machine may have jumbled it. Above all, I should want to assign to a post-editor the task of choosing the most satisfactory preposition from the battery we shall have to provide in the TL for each preposition in the FL, and likewise to choose the appropriate equivalent from among the less formidable array of multiple choices for conjunctions. A monolingual general pre-editor, however, cannot efficiently aid in the interpretation of meaning-bearing words that have diverse significance in diverse contexts. A monolingual post-editor will inevitably be confronted with all sorts of contexts with which he is not familiar. Bilinguals, as I have pointed out, will be only a little better equipped to cope with the problem. For, if we assume we can resolve patterns of syntactic connection from the FL into the TL -- as I am sure we can -- and if we assume that we can supply at a reasonable speed all the possible significances in the TL for each meaning-bearing word in the FL, then the competence required for the ultimate interpretation of the text is not linguistic insight or skill, but

by

R.H. Richens and A.D. Booth

lisez, lisez, lisez; jetez vos grammaires
en feu.

Schlegel.

The following outline summarizes some suggestions on ways in which translation may be mechanized, worked out by the authors in 1946-52. The treatment is not exhaustive and many modifications in detail would certainly be necessary should the ideas here mooted be put into active operation. It is considered however that it would be serviceable to describe the techniques here envisaged in their present rudimentary form, rather than await their further refining, since they may prove of interest to others working along the same lines.

The paper is divided into three parts. The first deals with general principles, the second with specimen translations, while the third considers in detail the working of some specific mechanical translation schedules.

I. General principles of mechanized translation

A language is a series of symbols representing ideas. The simplest conceivable written language would have one symbol per idea, together with appropriate rules, possibly involving extra symbols for syntactical relations. Such a language does not exist. The nearest approach is probably Chinese or the numerical notation in general use. In both these cases the symbols represent ideas directly. Usually, written languages symbolize, not ideas, but other symbols, namely sounds, spoken words, that represent ideas. Since,

II. Some specimen translations

Samples are given in this section of the sorts of translation to be expected from the application of the above-mentioned procedures to specific languages. The sentences chosen have been selected at random from the biological literature in these languages, merely avoiding sentences with proper names or numerical data. For convenience of type-setting, the samples are taken only from languages normally written in Roman script, but sentences from two oriental languages, Arabic and Japanese, have been transliterated to illustrate further points.

To illustrate the relative unimportance of syntax, many near-vacuous words, in particular the articles, have been treated as vacuous, and no indication is given of grammatical forms indicating the singular number, third person, or present tense. The resultant translation thus combines an English vocabulary with a grammar or lack of grammar more characteristic of Chinese. It is probable that a somewhat less extreme treatment of near-vacuous forms would be more useful in practice.

The grammatical abbreviations used are as follows: --

- A consecutive
- D dative
- F future
- G genitive
- L locative
- M multiple, plural or dual
- N nominative
- O oblique
- P past
- Q present
- R relative

X-PN 242

H22

Studies in Mechanical Translation

No. 1.

M T

* * * * *

by

Erwin Reifler

Department of Far Eastern and Slavic Languages and Literature

University of Washington

LIST OF ATTENDEES

CONFERENCE ON MECHANICAL TRANSLATION

June 17, 18, 19

NAME	AFFILIATION
Dr. A. Don Booth,	Director, Electronic Computer Section, Birbeck College, London
Prof. William E. Bull,	Department of Spanish, University of California, Los Angeles
Prof. Stuart C. Dodd,	Director, Washington Public Opinion Laboratory, University of Washington, Seattle
Prof. Leon Dostert,	Director, Institute of Languages and Linguistics, Georgetown University, Washington, D.C.
Dr. Olaf Helmer,	Director of Research, Math. Division, Rand Corporation, Santa Monica, California
Dr. Harry D. Huskey,	Assistant Director, National Bureau of Standards Institute for Numerical Analysis, University of California, Los Angeles
Mr. Duncan Harbin,	Department of Defense, Washington, D.C.
Prof. Victor A. Oswald,	Department of Germanic Languages, University of California, Los Angeles
Prof. Erwin Reifler,	Far Eastern and Russian Institute, University of Washington, Seattle
Mr. Victor H. Yingve,	University of Chicago, Chicago, Illinois
Dr. Yehoshua Bar-Hillel,	Research Associate, Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge 39, Massachusetts
Mr. Jay W. Forrester,	Director of Digital Computer Laboratory, MIT
Prof. William N. Locke,	Department of Modern Languages, MIT
Dr. James W. Perry,	Research Associate, Center of International Studies, MIT
Dr. Vernon State,	Director of Libraries, MIT
Dr. Jerome B. Wiesner,	Director, Research Laboratory of Electronics, MIT
Mr. A. Craig Reynolds, Jr.,	Endicott Laboratories, ILM, Endicott, New York
Du-ley A. Buck,	Research Assistant, Electrical Engineering Department, MIT

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BACKGROUNDS
OF
EUROPEAN LITERATURE

ROD W. HORTON
AND
VINCENT F. HOPPER

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BIJBEL EN ROMANTIEK

AFSCHEIDSCOLLEGE VAN
Prof. Dr GERARD BROM

ALS HOOGLEERAAR IN DE NEDERLANDSE
EN DE ALGEMENE LETTERKUNDE AAN
DE R. K. UNIVERSITEIT TE NIJMEGEN
OP VRIJDAG 23 MEI 1952



DEKKER & VAN DE VEGT N.V.
NIJMEGEN - UTRECHT - 1952